

Andrew J. Sasso
Director, Regulatory Affairs
Toronto Hydro-Electric System Limited
14 Carlton Street
Toronto, ON M5B 1K5

Telephone: 416.542.7834
Facsimile: 416.542.3024
regulatoryaffairs@torontohydro.com
www.torontohydro.com



May 31, 2019

Via RESS

Ms. Kirsten Walli
Board Secretary
Ontario Energy Board
PO Box 2319
2300 Yonge Street, 27th floor
Toronto, ON M4P 1E4

Dear Ms. Walli:

**Re: OEB File No. EB-2018-0165 Toronto Hydro-Electric System Limited ("Toronto Hydro")
Custom Incentive Rate-setting ("Custom IR") Application for 2020-2024 Electricity Distribution
Rates and Charges – Exhibit M3 - Reply Report to PEG Evidence**

Toronto Hydro's Application filed on August 15, 2018 included a report by Power System Engineering Inc. ("PSE") with respect to productivity benchmarking. The OEB retained Pacific Economics Group Research LLC ("PEG") to review that evidence.

On March 20, 2019, OEB Staff filed a report prepared by PEG entitled "IRM Design for Toronto Hydro-Electric System Limited" ("PEG Evidence") as Exhibit M1. On April 24, 2019, OEB Staff submitted responses to interrogatories filed with respect to the PEG Evidence. On May 22, 2019, OEB Staff filed an updated version of the PEG Evidence.

Enclosed with this letter is a supplemental report by PSE, filed as Exhibit M3, in reply to the PEG Evidence. Physical copies will follow via courier.

Please contact me directly if you have any questions or concerns.

Respectfully,

A handwritten signature in blue ink that reads "Andrew J. Sasso".

Andrew J. Sasso
Director, Regulatory Affairs
Toronto Hydro-Electric System Limited

cc: Lawrie Gluck, OEB Case Manager
Michael Millar, OEB Counsel
Parties of Record
Amanda Klein, Toronto Hydro
Daliana Coban, Toronto Hydro
Charles Keizer, Torys LLP



Reply Report to PEG's Report ("IRM Design for Toronto Hydro-Electric System")

Prepared by:

Power System Engineering, Inc.
May 31, 2019

Reply Report to
PEG's Report ("IRM Design for Toronto Hydro-Electric
System")

Contact

Steve Fenrick 608.334.5994

Table of Contents

1	Introduction and Summary of Results	3
1.1	Procedural History.....	3
1.2	Conclusions of the Reports	3
1.3	Structure of the PSE Reply Report.....	3
1.4	PSE’s Results and PEG’s Results Converge.....	3
1.5	PEG Has Followed PSE’s Approach in Addressing Board Issues from Prior Proceeding 5	
2	Critiques of PEG’s Cost Benchmarking	6
2.1	Inconsistency in PEG’s Approach.....	6
2.1.1	PEG Conducted Capital Price Levelization in 2012 for Toronto Hydro and in 2008 for the Rest of the Sample.....	6
2.1.2	Ratcheted Peak Demand Variable Begins in 1995 for U.S. Sample and 2002 for Toronto Hydro.	7
2.1.3	PEG’s Asset Price Escalation Measure is Inconsistent.....	7
2.1.3.1	PEG’s Use of an Index that Includes Non-Electric Distribution Utilities Introduces a Bias.....	7
2.1.3.2	Using 2012 as the Levelization Year Is a Step in the Right Direction	8
2.2	Additional Concerns with PEG’s Methodology.....	8
3	Reply to PEG Critiques.....	10
3.1	Reply to PEG’s “Major Concerns”	10
3.2	Replies to PEG’s Other Concerns	14
3.3	Implicit Stretch Factor.....	15
4	Reply to PEG’s Plan Design Comments.....	17
4.1	Summary of PSE and PEG Results	18

1 Introduction and Summary of Results

1.1 Procedural History

In July 2018, Power System Engineering, Inc. (“PSE”) prepared a total cost and reliability benchmarking report (“PSE Report”) for Toronto Hydro-Electric System Limited (“Toronto Hydro” or “the Company”). The PSE Report evaluated Toronto Hydro’s historical and projected cost and reliability levels. In March 2019, Pacific Economics Group Research LLC (“PEG”) produced a report (“PEG Report”) that provided comments on the PSE Report and provided an opinion on certain aspects of Toronto Hydro’s Custom IR application. Toronto Hydro submitted interrogatory questions to PEG regarding the methodologies in the PEG Report. PEG submitted answers to the interrogatories (“PEG Interrogatory Answers”) on April 24, 2019. On May 22, 2019 PEG issued a revised report (“PEG Revised Report”) that made certain corrections to some errors identified in PEG’s data and analysis.

This report (“PSE Reply Report”) is a reply to the PEG Report, PEG Revised Report, and the PEG Interrogatory Answers.

1.2 Conclusions of the Reports

The conclusions of the PSE Report and the PEG Revised Report differed in some aspects. PSE recommended a 0.30% stretch factor, and the PEG Revised Report recommended a 0.45% stretch factor. There were also some differences regarding model datasets and variables. However, both reports employed the same overall strategy—econometric analysis of total costs and reliability outcomes.

PSE’s study results show that Toronto Hydro’s total costs are below benchmark costs and suggest a 0.30% stretch factor. PEG’s corrected results are nearing the threshold between a 0.30% stretch factor and the 0.45% stretch factor. In the 4th Generation IR proceeding this threshold is a benchmarking score of +10%. PEG’s 2020-2024 average score is now +11.6% when using their corrected results found in M1-TH-026 (f).

1.3 Structure of the PSE Reply Report

In Section 1 of this PSE Reply Report, we summarize our conclusions. Section 2 summarizes some deficiencies with the cost benchmarking approach in the PEG Report; we show why the PSE results are the more accurate depiction of Toronto Hydro’s total cost performance. Section 3 provides specific responses to PEG’s critiques of the PSE Report. Section 4 discusses PEG’s additional comments regarding Toronto Hydro’s custom IR plan design. Throughout the report, we highlight the areas where progress and consensus on total cost benchmarking of Toronto Hydro has been made.

1.4 PSE’s Results and PEG’s Results Converge

Table 1 below provides total cost (“TC”) benchmarking results for the three most recent historical years and for the projected years. The results in the “PSE TC Results” column reflect the analysis from the PSE Report, with a dataset update to include 2017 data (with no other changes made).

The column labeled “PEG TC Results (2012 Capital Level)” shows the updated PEG results from their Interrogatory Answers. PEG corrected their results from the initial PEG Report in their response found in M1-TH-026 (f).¹

Table 1 PSE Total Cost Results vs. PEG Total Cost Results

Year	PSE TC Results	PSE—Average Results Prior 3 Years	PEG TC Results (2012 Capital Level)	PEG—Average Results Prior 3 Years
2015	-18.4%		-7.6%	
2016	-15.7%		-3.1%	
2017	-13.8%		-0.2%	
2018	-10.5%	-16.0% (SF=0.15%)	3.5%	-3.6% (SF=0.30%)
2019	-9.3%	-13.3% (SF=0.15%)	4.8%	0.1% (SF=0.30%)
2020	-7.2%	-11.2% (SF=0.15%)	7.5%	2.7% (SF=0.30%)
2021	-5.5%	-9.0% (SF=0.30%)	9.4%	5.3% (SF=0.30%)
2022	-3.3%	-7.3% (SF=0.30%)	11.8%	7.2% (SF=0.30%)
2023	-1.6%	-5.3% (SF=0.30%)	13.8%	9.6% (SF=0.30%)
2024	-0.1%	-3.5% (SF=0.30%)	15.4%	11.7% (SF=0.45%)
CIR Avg.	-3.5%		+11.6%	

In Table 1 we show each model’s annual benchmarking score and included the average of the prior three years for both PSE’s results and PEG’s results. We also included the applicable stretch factor (SF) based on the 4th Generation SF cohorts.²

As can be seen in the table, PSE’s results suggest a 0.30% SF for the majority of the Custom IR period and for the 2020 to 2024 average. PEG’s model results also suggest a 0.30% SF for the majority of the Custom IR period. If the full custom IR forecasted period is averaged, PEG’s recommended stretch factor becomes 0.45%.

This convergence in results toward a 0.30% stretch factor is primarily due to the advancement of the congested urban variable. PSE and PEG each use the new variable in their models. The congested urban challenges of Toronto Hydro are now being recognized in both models, and the total cost benchmarking results of both consultants reflect this advancement.

¹ In PEG’s response to interrogatory questions M1-TH-026 (e) and (f), PEG calculated total costs using 2008 and 2012, respectively, as the capital levelization year. In Table 1 we show the results using the newer 2012 capital levelization found in part (f) of the interrogatory response. In Section 3.1.1 we discuss why using the more recent capital levelization provides the most accurate depiction and partially mitigates the impact of PEG using inconsistent asset price escalators between Toronto Hydro and the rest of the sample. We note that in the PEG Revised Report, PEG used the older and less accurate 2008 capital levelization year.

² The 4th Generation SF cohorts are based on the 3-year historical total cost benchmarking scores. Average scores greater than 25%, between 10% to 25%, between 10% to -10%, between -10% to -25%, and less than -25% suggest a SF of 0.60%, 0.45%, 0.30%, 0.15%, and 0.00%, respectively.

1.5 PEG Has Followed PSE's Approach in Addressing Board Issues from Prior Proceeding

As discussed in the PSE Report, the Board Decision in the company's last application laid out three main points of difference between the benchmarking consultants regarding the Company's total cost benchmarking:

1. the urban core variable,
2. approach to CDM costs, and
3. asset price inflation costs (capital cost escalation rate).

These three points are addressed and discussed at length in the PSE Report, and the PSE solutions to these points have been essentially matched by PEG in their study. PSE addressed the urban core variable issue by conducting an extensive aerial block-by-block review of all cities served by a utility in the sample with populations above 200,000. This produced the new urban variable that measures the percentage of service territory designated as "congested urban." PEG has now inserted and included the same variable in its TC model.³

PSE addressed the CDM cost issue of the Board by eliminating the customer service and information ("CSI") expenses from the entire sample. U.S. utilities will sometimes record their CDM expenses within the CSI expense category. The elimination of CSI expenses from the cost definition assures cost consistency in this regard. PEG has followed the same approach in its TC model.⁴

PSE addressed the asset price inflation issue by using the Conference Board of Canada price projections for "Engineering Structures, Electric power generation, transmission, and distribution." This produces a lower inflation assumption than PSE had previously used. PEG has followed the same approach to projecting asset price inflation in its TC model.⁵

³ M1-TH-004.

⁴ PEG Report, p. 39: "We accordingly follow the path of PSE by excluding all CS&I expenses from the costs of US utilities in our study."

⁵ M1-TH-023.

2 Critiques of PEG's Cost Benchmarking

PSE reviewed PEG's total cost study (the PEG Report as modified by the PEG Interrogatory Answers and then in the PEG Revised Report). This section is limited to our concerns of the PEG approach that we believe will have a relevant impact on the Toronto Hydro total cost benchmarking result. In this section we are only commenting on the total cost benchmarking study of PEG. Our views on the disaggregated benchmarking of OM&A, capital cost, and capex (provided by PEG on an experimental basis) are found in Section 3.

Our concerns with the PEG methodology are divided into two categories. The first category relates to concerns about consistency. A central principle of econometric benchmarking is that costs, prices, and variables should be defined consistently for the studied utility (Toronto Hydro in this case) and the rest of the sample. Additional concerns are grouped in the second category. Again, these two categories of concerns relate to issues that could have a meaningful impact on the study results.

2.1 Inconsistency in PEG's Approach

2.1.1 PEG Conducted Capital Price Levelization in 2012 for Toronto Hydro and in 2008 for the Rest of the Sample.

In examining PEG's working papers, we noticed a significant error in PEG's code that resulted in an inconsistent capital levelization year between Toronto Hydro and the rest of the sample; this error materially affects the benchmarking result. PEG has acknowledged the error in its Interrogatory Answers and has now made a correction in the PEG Revised Report.

A capital levelization is conducted in order to adjust for the regional price differences in constructing capital assets. Both PEG and PSE use the city location factors found in the RSMeans Heavy Construction Cost Data publication (updated annually). The levelization needs to be done in the same year for all utilities, since the capital price is then inflated using the asset price escalator after the levelization takes place (or deflated for years prior to the levelization year). By levelizing Toronto Hydro's capital price in a later year than the rest of the sample, PEG's dataset will never contain, in a given year, the relative levelization implied by the RSMeans publication. In each year of PEG's sample, the relative levelization will be lower for Toronto Hydro, which in turn, will unduly harm the company's benchmark result.

In PEG's original study, Toronto Hydro's levelization occurred in 2012, whereas the rest of the sample was levelized in 2008. This skewed the relative levels of the capital price for Toronto Hydro to all other utilities in the sample, since the rest of the sample had additional years of asset price inflation included in the asset price relative to Toronto Hydro.

In the interrogatory M1-TH-026 (d) we pointed out this error, and PEG then acknowledged this error and its inconsistency with the rest of the sample in their response. Accordingly, PEG revised its results after correcting for this error in parts (e) and (f) of the same interrogatory. Part (e) of the response used the older 2008 capital levelization, part (f) used the newer 2012 capital levelization year. Correcting the inconsistency by using the older 2008 levelization year improved Toronto Hydro's total cost benchmarking score by about 5% relative to PEG's original report.

Correcting the inconsistency with the newer 2012 levelization year improved the company's score by about 9% relative to the total cost results reported in the initial PEG Report.

Given PSE's concerns regarding PEG's inconsistent capital inflation assumptions (discussed below in Section 2.1.3), PEG's correction using the more recent year of their response to interrogatory M1-TH-026 is, on a relative basis, more accurate than its results using the older year of their answer (although both results suffer from other problems).

PEG used the less accurate result using the older 2008 capital levelization year of their response in the PEG Revised Report. While this improves Toronto Hydro's total cost score relative to the original PEG Report, it is nonetheless, the less accurate result and inflates Toronto Hydro's benchmarking score compared to using the more recent 2012 capital levelization.

2.1.2 Ratcheted Peak Demand Variable Begins in 1995 for U.S. Sample and 2002 for Toronto Hydro.

There are two output variables included in both PEG's and PSE's total cost model. These are: (1) the number of customers served, and (2) ratcheted peak demand. While the number of customers for each utility match between the two consultants, PEG modified the ratcheted peak demand variable definition for the U.S. sample. PEG's ratcheted peak demand variable takes the highest peak demand value for each U.S. utility, starting in 1995. However, for Toronto Hydro, PEG's variable takes the highest peak demand value, starting in 2002. This provides the U.S. utilities the advantage of seven more years to raise their ratcheted peak demand variable. PEG agreed that this inconsistency is present in their model (see PEG's response to M1-TH-018) but has not, to our knowledge, corrected for this inconsistency in the PEG Revised Report.

PSE acknowledges that PEG (or any other consultant) is unable to identify the historical peak demands for Toronto Hydro prior to 2002. However, if PEG continues to include U.S. observations prior to 2002 in its sample (which PSE believes is unhelpful), PEG should be defining one of the most important variables in its model consistently. PEG's inconsistency biases the results against Toronto Hydro.

2.1.3 PEG's Asset Price Escalation Measure is Inconsistent

2.1.3.1 PEG's Use of an Index that Includes Non-Electric Distribution Utilities Introduces a Bias

PEG's asset price escalation measure is inconsistent, and therefore, produces inconsistent capital price inflation between Toronto Hydro and the rest of the sample. PEG used the Handy-Whitman Index specific to the electric distribution sector for the U.S. sample, but then used an Ontario index that is specific to all utilities, even including non-electric utilities. The index PEG used for Toronto Hydro includes many types of utilities: natural gas, water and sewer, power generation, transmission, and distribution utilities.

The inconsistency in PEG's approach between Toronto Hydro and the rest of the sample is easy to see when its impact on the capital price is examined. Toronto Hydro's capital price increases by an average of 0.5% per year from 2005 to 2017. PEG confirms this in M1-TH-030 (a). PEG then confirms that this is the lowest capital price growth rate in the entire PEG sample in M1-TH-030 (b).

To see the unreasonableness of Toronto Hydro's capital price inflation calculated in PEG's sample, we can look to PEG's answer in M1-TH-030 (c). PEG states that one of Toronto Hydro's closest peers in the dataset, Consolidated Edison of New York City, had an assumed capital price inflation of 7.2% per year from 2005 to 2017 in the PEG dataset. Madison Gas and Electric had an assumed inflation rate by PEG of 6.8%.

Most other utilities in the sample will have capital price inflation around the values of Consolidated Edison and Madison Gas and Electric in the PEG dataset because of PEG's inconsistent treatment of the asset price escalator. No utility in the dataset has an assumed inflation rate anywhere near the 0.5% assumed for Toronto Hydro. This is because the PEG index produces an unrealistic capital price inflation for Toronto Hydro, especially in comparison to the assumption used for the rest of the sample.

2.1.3.2 Using 2012 as the Levelization Year Is a Step in the Right Direction

PEG acknowledges that the impact of their inconsistency on Toronto Hydro's benchmarking results are reduced when the capital levelization year is more recent when they state in their answer to M1-TH-030 (c):

This reflects rapid growth in the construction cost index over the 2006-2008 period. The relevance of this to the benchmarking of Toronto Hydro's cost is reduced by the fact that the levelization of the asset price takes place in 2008 in the PEG work. The trend in the asset price for Consolidated Edison was 3.08% vs. 2.57% for THESL since 2008.

Yet there remains an inconsistency and a bias against Toronto Hydro in PEG's approach. The asset price inflation assumption should be consistent. As we stated in Section 3.1.1, for this reason PEG's correction of their error leads to a more accurate result when they revise the capital levelization year to 2012 (still incorrect for other reasons, but less so). The switch from 2008 to 2012 for the levelization year would be a step in the right direction: it reduces and mitigates the inconsistent and unreasonable asset inflation assumption used by PEG.

Our suggestion is that if PEG insists on using inconsistent asset price escalators between the studied utility and the rest of the sample, they should, at least, use the most recent RSMeans capital levelization year available to mitigate these differences for the recent results and projections.⁶ Using consistent asset price escalators is the most accurate approach, but if this is not done, then using the most recent RSMeans capital levelization year available would at least lessen the bias against Toronto Hydro's recent results.

2.2 Additional Concerns with PEG's Methodology

The following are additional concerns PSE has with PEG's methodology.

- 1. PEG's sample does not include any Ontario distributors.** PEG did not include the six Ontario distributors that PSE included in our sample. The PSE sample is more comprehensive and more reflective of a large utility serving in Ontario.

⁶ RSMeans publishes these estimates on an annual basis.

2. **PEG's capital data series for U.S. starts in 1964 and is impossible to verify and could contain errors.** Please see the response to PEG's Concern #8 in Section 3 of this report. PEG did not provide the raw data sources, despite those being requested in M1-TH-007 (a). This data cannot be readily verified by an independent consultant, and there is a propensity for errors when using data that cannot be verified and are over 55 years old.
3. **PEG's capital series for Toronto Hydro is based on imputations and assumptions from 1989 to 2002.** PEG requires assumptions and imputations to estimate Toronto Hydro's capital series, due to PEG's choice to begin the capital series in 1989 rather than 2002, when verifiable data for each year exists. PEG's data requires assumptions that prove to be inconsistent with the rest of the sample, as shown in their response to M1-TH-006 ("In preparing responses to these questions, PEG noted some inconsistencies with its data and methods relative to that used by PSE.")

One of PEG's original assumptions was that the retirement rate is set at 0.5%. However, PEG shows in part (c) of their response to M1-TH-006 that the average U.S. retirement rate is 0.84%. Further, PEG assumes no adjustments occurred for Toronto Hydro from 1989 to 2002. One explanation for PEG's imputations having Toronto Hydro's capital additions exceeding \$450 million in 1996 is that their assumption of "no adjustments for Toronto Hydro from 1989 to 2002" is wrong. As discussed in our response to PEG's Concern #8 found in Section 3 of this report, this \$450 million number is implausible and provides evidence of an error in one of PEG's assumptions. Further, if PEG's 1989 method was implemented for the other six Ontario distributors, five of the six would have negative plant additions in at least one year. This, again, shows that PEG's method produces implausible results, and that PSE's approach of starting the capital series in 2002 is the better one.

4. **PEG's model does not contain quadratic business condition variables, including two PEG states are significant cost drivers.** Please see our response to PEG's Concern #7 found in Section 3. PEG excluded quadratic variables that they themselves identified as statistically impacting cost, resulting in an underfitting of the model and omitted variable bias.
5. **PEG's sample period starts in 1995.** PEG begins their U.S. sample period in 1995. PSE began the U.S. sample in 2002. Beyond the inconsistency impact this decision had on PEG's ratcheted peak demand variable, expanding an already large sample that already contained over 1,300 observations to include the years of 1995 to 2001 is unnecessary and inserts observations that are less reflective of the current-day industry. The benchmarking results are mainly used to examine Toronto Hydro's recent and projected cost performance, and including observations from the 1990s detracts from that objective. Technology advances, regulatory requirements, and reliability and service quality expectations have evolved throughout the years. A more contemporary sample is more reflective of the current day reality within the industry.

3 Reply to PEG Critiques

Starting on p. 21 of the PEG Report, PEG raises some concerns it has with the benchmarking study conducted by PSE.⁷ For the most part, we disagree with those concerns. We provide our replies to each concern below.

3.1 Reply to PEG's "Major Concerns"

PEG Concern #1: PEG claims "it seems equally sensible to use the estimated urban area as the variable in a cost model since cost will clearly be higher the larger is the urban area served."

PSE Reply to Concern #1: Notwithstanding its stated concern, PEG uses the identical "congested urban" variable in its total cost model that PSE uses in our total cost model.⁸ The congested urban variable measures the percentage of territory that is highly congested with urban features (high rise buildings, dense blocks, etc.) that lead to higher costs, relative to territory that is less costly to serve (suburban areas and urban areas not at the level of "congested urban"). Most other business condition variables in both PSE and PEG's models are also percentage variables (percent forestation, percent electric, percent AMI, percent underground). Using the total estimated congested urban area, as opposed to the *percentage* area that is congested urban, would leave out an important component of the variable.

PEG Concern #2: PEG states that if Con Ed or Toronto Hydro have unusually poor performances, the urban challenge variable would reflect that. PEG states, "The parameter estimate for PSE's urban challenge variable is, in any event, very sensitive to the inclusion of Con Ed in the sample."

PSE Reply to Concern #2: PSE agrees the urban challenge variable will be impacted by the inclusion of Con Ed. The Toronto Hydro result will not be impacted by the performance of Toronto Hydro, however, since Toronto Hydro is excluded from the sample when constructing the benchmark. The fact that Con Ed will have an impact on the congested urban variable is to be expected. In PEG's model, Con Ed will also have a similar impact.

The inclusion of Con Ed is essential to the accuracy of the parameter estimate, due to Con Ed having a congested urban percentage that is greater than Toronto Hydro's. Con Ed is an outlier regarding the value, and its inclusion in the sample makes Toronto Hydro less of an outlier. New York City is one of the largest metropolitan areas within North America and it is served by Con Ed. A significant portion of Con Ed's service territory includes New York City. Toronto Hydro is in a similar situation in serving the City of Toronto. The benchmarking study is more accurate for Toronto Hydro with Con Ed included in the sample than if it were not because Con Ed's congested urban values are above Toronto Hydro's and enable the parameter estimates to more precisely reflect the cost impacts at the Toronto Hydro variable values. The fact is that many

⁷ The PEG Report and PEG Revised Report appear to have minimal wording changes with the only significant changes being in the tables and figures that provide the results subsequent to PEG correcting some of its identified errors. Therefore, we will refer to the PEG Report yet the page numbers and discussions are applicable to both the original PEG report and PEG's corrected report.

⁸ M1-TH-004.

variables will have outliers, on either end of the spectrum. PSE and PEG took the same approach of including Con Ed, which is the best approach available.

PEG Concern #3: PEG states on p. 22 of its report that “PSE’s model also has an interaction term between the share of assets that are undergrounded and its urban challenge variable.” PEG correctly states that there is undergrounding in the utility industry in both congested urban and non-congested urban areas. PEG also states that the cost of direct-buried lines is considerably lower than the cost of underground vaulted lines.

PSE Reply to Concern #3: We agree that: (i) our model includes an interaction term; (ii) underground assets are found in places other than in congested urban areas; and (iii) the costs of different types of undergrounding can be considerably different. PEG’s last two points highlight why an interaction term needs to be included in the model. If undergrounding was only found in congested urban areas, or if the costs of different undergrounding types were similar, then the interaction term would be unnecessary. As PEG correctly states, neither is the case. PSE includes the interaction term to disaggregate the more expensive congested urban undergrounding costs from other types of undergrounding costs (e.g. suburban direct-buried); the latter type will tend to be considerably lower cost.

PEG Concern #4: On p. 22 of its report, PEG raises a concern about the inclusion of the Ontario dummy variable.

PSE Reply to Concern #4: There are many differences between Canada and the United States. Currencies, health care regulations, regulatory environments, and weather are some obvious ones. The dummy variable encapsulates the cost impact of those differences. We note two things. The first is that if the Ontario dummy variable was eliminated from PSE’s model, the total cost benchmarking score for Toronto Hydro would improve. The second is that PEG is not able to include the Ontario dummy variable because the PEG sample used to benchmark Toronto Hydro only includes U.S. utilities and no other Ontario distributors. The PSE sample includes both Ontario and U.S. utilities and is a more comprehensive total cost benchmarking sample.

PEG Concern #5: On p. 22 of their report, PEG raises a concern that we did not include a rural challenge variable.

PSE Reply to Concern #5: PSE did test the variable and found it was not quite statistically significant. We have three criteria for including a variable into a model:

- 1) the variable must have a theoretical and logical engineering basis for why it impacts cost,
- 2) the parameter estimate must align with that theory, and
- 3) the parameter estimate needs to be statistically significantly greater than zero at the 90% confidence level.

The rural variable that PSE attempted met criteria #1 and #2, but failed criteria #3. We are not opposed to including a rural challenge variable and, in fact, did include one in our benchmarking research for Hydro One Networks. In the Hydro One case, the variable was statistically significant and met all three criteria for model inclusion.

We also note that the inclusion of the rural challenge variable, if added, improves the total cost benchmarking score of Toronto Hydro.

PEG Concern #6: On p. 22 of their report, PEG questions why PSE needed to include an undergrounding variable given the inclusion of the congested urban variable, undergrounding not being fully exogenous, and the cost differences of undergrounding.

PSE Reply to Concern #6: PSE notes that PEG did include both a congested urban variable and a measure of percent undergrounding (constructed as a percent overhead variable) in their reliability model for SAIFI. This is inconsistent: for PEG to say they are not convinced that both variables are needed for a total cost model, but they are needed for PEG’s reliability model.

We agree that undergrounding is not *fully* exogenous, but it certainly is at least partially exogenous. As PEG states earlier on p. 22 of the PEG Report, undergrounding of assets occurred “due in part to municipal requirements.”

The second rationale for PEG’s uncertainty regarding the undergrounding variable and congested urban variable is that capital costs vary with the types of undergrounding. Undergrounding assets in congested urban areas will likely necessitate vaulting, and will be far more costly than directly burying lines. For this reason, PSE includes both an undergrounding variable and an undergrounding variable interacted with the congested urban variable; this measures the cost differences in undergrounding assets in congested urban areas relative to areas where undergrounding is less costly.

PEG Concern #7: On p. 22 of their report, PEG raises a question about the number of quadratic terms in our model.

PSE Reply to Concern #7: The quadratic terms are necessary for an accurate benchmarking result. PEG itself has statistically tested and found evidence that two of the quadratic variables included by PSE significantly impact cost and enhance the model’s ability to predict cost more accurately.⁹ These two are the percent forestation and the congested urban variable.

PEG chose not to include any of the quadratic variables despite finding statistical evidence that two of them are important and statistically significant cost drivers. Not including these variables creates bias in PEG’s model—omitted variable bias. PEG says in their response that they did not include the variables “to avoid the possibility of overfitting the model.” However, they are underfitting the model, and this impacts the accuracy of their reported results. If PEG were to include the two quadratic terms they found to be significant, their results for Toronto Hydro would materially improve.

Further, the consequences of underfitting the model (i.e., omitted variable bias) tend to be worse than overfitting the model. While including these statistically significant variables gives us unbiased and consistent estimates of the coefficients of the “true” total cost model, underfitting the model by excluding relevant variables will produce coefficients that are biased and inconsistent.¹⁰

⁹ See PEG’s response to M1-TH-21.

¹⁰ Please see p. 474 in Gujarati, Damodar N. and Dawn C. Porter “Basic Econometrics” Fifth Edition, and the entire

PEG Concern #8: PSE used a capital benchmark year of 2002 for all the Ontario distributors (including Toronto Hydro), and 1989 for the rest of the U.S. sample. PEG used 1989 as the capital benchmark year for Toronto Hydro (recall that PEG did not include any other Ontario distributors in their model) and 1964 as the capital benchmark year for the rest of the U.S. sample.

PSE Reply to Concern #8: For PEG to go back to the 1989 capital benchmark year for Toronto Hydro, it required PEG to make certain assumptions and imputations on the capital addition series from 1989 to 2002, since directly reported data was not available for all years. PEG's assumptions include: (i) assuming assets are retired at 0.5% of the gross plant value, and (ii) the difference in the gross plant value reflects capital additions, rather than an adjustment.

PEG's imputations produce an implausible hypothetical result for Toronto Hydro in 1996, where PEG's imputations resulted in an estimate of Toronto Hydro having plant additions of over \$450 million. This was quadruple the typical number in the 1990s, and was not exceeded in any year until 2014. PEG states in their response to M1-TH-006 (c) that the retirement rate assumption does not match the U.S. retirement rate and, in part (d) of the same interrogatory, PEG says that the accuracy of the values will produce plausible values "so long as the gross plant values can be relied upon."

Beyond the implausible value for Toronto Hydro, we examined whether other plant addition values for the other six Ontario distributors would be suspect if the capital benchmark was pushed back to 1989. Out of the six other Ontario distributors included in the PSE sample, five of them would have had negative plant additions values in at least one year (if PSE had begun the capital series in 1989 using the assumptions that PEG applied to Toronto Hydro). Since these assumptions lead to implausible conclusions, they are almost certainly false. Pushing back the capital benchmark start year using erroneous assumptions does not increase the accuracy of the benchmarking research.

The other item mentioned by PEG is that they use a 1964 capital benchmark year for the U.S. sample, rather than the 1989 year used by PSE. PSE started the capital series in 1989 because that was the first year of data that is readily available and verifiable to anyone with an SNL subscription (SNL is a standard and widely used third-party data vendor within the utility industry). 1989 is 30 years ago and using that year provides a robust set of data. However, PEG goes back to 1964, using arcane data that can only be manually tracked down, if it can be tracked down at all, with extensive effort. PEG refuses to provide, or cannot provide, the raw sources of data, and this data cannot be readily verified by another consultant.¹¹

It is difficult to assure that data over 50 years old is accurate and properly adjusted for. This is especially true when the raw data sources can no longer be readily observed or verified. Yet, there will be little to no increase in accuracy even assuming all of this work was properly done. There is likely a decrease in accuracy because there is a strong possibility the data series contains errors, and consultants cannot readily double-check the accuracy of the data.

section of 13.4 where the book discusses the issue of underfitting versus overfitting an econometric model.

¹¹ M1-TH-007.

PEG Concern #9: PEG states on p. 24 of their report: “Based on our review, our professional opinion is that the most promising replacement for the EUCPI in Ontario distributor cost research is Statistics Canada’s implicit price index for the capital stock of the Ontario utility sector.”

PSE Reply to Concern #9: PEG’s chosen index includes natural gas distribution, water and sewer, and electric generation, transmission, and distribution. We also note in Section 2.1.3 that PEG’s choice for Toronto Hydro’s price index is inconsistent with the rest of the sample, because the rest of PEG’s sample is using an index specific to the electric distribution sector. This inconsistency produces the unreasonable result in the PEG dataset that Toronto Hydro has a capital price inflation rate from 2005 to 2017 of 0.5%, versus much higher growth rates for the rest of the sample. This improper assumption means Toronto Hydro has, by far, the lowest capital price inflation in PEG’s entire dataset. This is simply unreasonable, especially given the City of Toronto’s brisk construction growth during the sample period.

The Handy-Whitman Indexes (“HWI”) used by PSE for all utilities, including Toronto Hydro, are specific to the electric distribution sector, and are a better depiction of the inflationary pressures of an electric distributor like Toronto Hydro. Toronto Hydro purchases assets in a global market, and electric distribution has specific commodities that are more relevant to electric distribution than other types of utilities, such as water and sewer or gas distribution. For example, electric distributors require a higher input of copper than most other utility sectors. The asset inflation index should reflect that reality. PEG notes in their response to M1-TH-008 that the HWI components that are fastest growing are the ones with higher copper input. Copper prices have increased substantially since 2000, and PEG’s choice of asset price escalator for Toronto Hydro will largely miss this component.

PSE notes that the HWIs are produced specific to regions within the U.S. We used the electric distribution HWI for the North Atlantic region, and then adjusted using the Canadian purchasing power parity index (“PPP”) to put the inflation assumption in terms of Canadian dollars. This is a better solution than PEG using the entire utility industry as a proxy for Toronto Hydro’s electric distribution asset price inflation. PSE also notes that PEG has used the HWI and applied it to productivity research on Ontario Power Generation. We believe that was the appropriate path for Ontario Power Generation and continues to be the best choice when benchmarking an electric distribution utility like Toronto Hydro.

3.2 Replies to PEG’s Other Concerns

PEG briefly raises a couple of “smaller concerns” regarding our use of fixed weights for the OM&A input price index and the choice of the employment cost index (pp. 24 and 25 of the PEG Report). These points will have minimal impact on the benchmarking results.

Regarding PEG’s question on the use of fixed weights for the OM&A input price index, this concern will have little to no impact on Toronto Hydro’s results. In any event, PSE’s use of the same assumption for all of the utilities (both Ontario and U.S.) is more consistent and accurate, since it is using the 4th Generation assumption for the Ontario distributors (70/30 weights), and uses that same assumption for the U.S. distributors.

Regarding PEG’s question on the choice of the employment cost index, PSE agrees with PEG that the total compensation index should have been used in the PSE study. Making this change will

have no meaningful impact on the Toronto Hydro result, as the growth rates in the two indexes are similar and PSE used the same index for both Toronto Hydro and the rest of the sample.¹²

On p. 25 of their report, PEG briefly raises a couple of “general concerns.” PEG suggests that PSE should provide evidence that suggests Toronto Hydro’s cost performance is improving after taking account of special circumstances and regarding providing disaggregated benchmarking results.

Regarding PSE providing additional evidence on Toronto Hydro’s cost performance, it is unclear how such evidence could be provided or how such a study could be conducted.

Regarding providing disaggregated benchmarking results, PSE cautions that the more granular the benchmarking becomes, the more challenging it becomes to provide an accurate result. There is a generic proceeding on Activities and Program Benchmarking (“APB”) that is the more appropriate forum for exploring how granular benchmarking results can be derived and provide useful information to utilities and the OEB.

PSE notes that total cost benchmarking is simpler than more granular benchmarking, and total cost benchmarking results in accuracy levels that are more certain. This is because:

- reporting differences become more pronounced as the data becomes more disaggregated,
- trade-offs between categories (such as capital and OM&A) can influence the granular results, and
- definitions of different activities become crucial.

While these issues tend to “wash out” with total cost benchmarking, they become crucial issues as the benchmarking becomes more granular. Further, granular benchmarking does not mean that the variables in the total cost model such as congested urban, forestation, input prices, etc. become irrelevant. On the contrary, proper adjustments for these variables can become even more important and crucial for an accurate view of performance in the activity or process being examined.

There is not the time available to produce proper disaggregated benchmarking results in this application. The difficulties and challenges must be well-thought out before results are given weight in the regulatory arena. The generic proceeding is the best venue for those considerations.

3.3 Implicit Stretch Factor

PEG challenges the notion that a 0% productivity target contains an implicit stretch factor on pp. 25-26 of their report. PEG does this on the basis of productivity trends they have calculated in the U.S.

The assertion by PEG that there is not an implicit stretch factor ignores the relevance of the Ontario distribution industry in setting the productivity target. PEG itself was the Board Staff’s consultant in the 4th Generation IR proceeding (EB-2010-0379); there they recommended setting the productivity target based only on the Ontario distribution total factor productivity (TFP) trend. In

¹² With the exception that Toronto Hydro’s index was adjusted for changes in the Canadian PPPs.

that proceeding they found the Ontario TFP trend to be -0.33% after excluding Hydro One and Toronto Hydro from the industry definition—this is essentially the same as saying there is an implicit stretch factor for this period. Evidence provided by PSE in the Hydro One Distribution case (EB-2017-0049) in our TFP report entitled “Total Factor Productivity Study of the Electric Distribution Functions of Hydro One and the Ontario Industry” showed the Ontario distribution industry TFP has declined further since PEG produced their -0.33% TFP estimate.

4 Reply to PEG's Plan Design Comments

Near the end of its report PEG provides some comments about custom IR plans (Toronto Hydro's plan and custom plans in general) and possible ratemaking reforms. PEG refers to a generic proceeding by the Alberta Utilities Commission at which possible ratemaking regulatory reforms were considered. PEG then briefly lists some possible reforms it suggests merit consideration.

Our understanding is that any ratemaking regulatory reforms would normally be considered by the Board at a generic proceeding, with stakeholder involvement and proper consideration of any proposals. We offer below some preliminary comments from a benchmarking and productivity perspective to some of PEG's suggestions. Much further analysis and research would need to be done to fully consider various suggestions and the implications of them.

On p. 64 of the PEG Report, PEG states that "it seems desirable to consider how to make Custom IR more mechanistic, incentivizing, and fair to customers while still ensuring that it is reasonably compensatory over time for efficient distributors." However, many of PEG's comments and suggestions seem to be contrary to that statement. PEG's suggestions include adding a special stretch factor to the C factor calculation, materiality thresholds, raising of the X factor, underfunding in the last year of the plan term, and reducing the budget by a material amount. These proposed items would either reduce the mechanistic nature of the Custom IR plan, reduce incentives, or would not be reasonably compensatory for an efficient firm.

The mechanistic nature and incentives within Custom IR are reduced if a special stretch factor that is not explicitly tied to cost benchmarking results is applied to the C factor formula. The incentive properties of stretch factors are derived from benchmarking results that are directly impacted by distributors' spending levels. When that link is weakened, and stretch factors become more *ad hoc* and arbitrary, and less formulaic, the power of those stretch factors to incentivize is diminished.

Some other considerations put forth by PEG tend to be items that would not offer reasonable compensation that matches the utility's identified capital needs. If the utility were "underfunded," as PEG states in one of its bullets, this would not provide reasonable compensation to an efficient firm. The introduction of markdowns analogous to the ACM/ICM mechanisms detracts from the ability of the company to retain reasonable compensation and set an incentive plan that is customized to the needs of the company. It also would introduce uncertainty for the utility.

PEG's commentary on pp.62-63 of their report states that customers would never receive the full benefit of the industry's productivity trend in the long run. This statement ignores the reality of Ontario incentive regulation containing a stretch factor. On average, utilities must exceed the industry's long run productivity by 0.30% due to the stretch factor. A higher cost utility will need to exceed the industry's MFP by even more on an annual basis. While numbers like 0.30% might not appear large at first, this expectation of exceeding the industry's MFP is compounded annually and results in a considerable cost savings to ratepayers over time.

PEG suggests consideration of an even larger stretch factor beyond the one mechanistically derived through total cost benchmarking or even to abandon the C factor approach entirely and consider some sort of markdown on the capex eligible for supplemental revenue. These suggestions have

the potential to undermine the incentive properties of the stretch factors themselves by making them more arbitrary rather than formulaic and would place an unknown and uninvestigated burden onto the company. PEG itself says these suggestions would require more investigation and are beyond the scope of the project.¹³

PEG correctly states that the stretch factors themselves already provide a “materiality threshold and dead zone for capital revenue”.¹⁴ Not only does the stretch factor already serve as a materiality threshold for capital revenue in the company’s Custom IR proposal but the presence of the C factor also creates a larger stretch factor and reduced revenue on the OM&A portion of the revenue requirement.¹⁵ Further, the increased stretch factor due to the proposed capital spending will not only increase the stretch factor in this plan but will tend to increase it in future plans as well as the capital cost portion of the measured total costs will continue to include the depreciated portion of the additional capex spending for decades to come.

All of this to say, stretch factors do contain substantial incentive properties. These properties are eliminated or diminished if the stretch factors are not formulaic and mechanistic but become arbitrary. Stretch factors will also have long-lasting effects on the company’s revenues and C factors will tend to raise stretch factors both in the current and subsequent plans. This will influence the allowed revenue requirement for years to come. The productivity expectation on the company in future plans will be higher due to the current proposed C factor, again, assuming stretch factors remain formulaic.

4.1 Summary of PSE and PEG Results

In respect to total cost benchmarking, PSE disagrees with some of PEG’s methodology choices and assumptions. However, there is to a certain extent a convergence of opinion regarding the overall methodology and variables, and regarding Toronto Hydro’s total cost results. PSE’s total cost result and PEG’s updated results are shown in Table 2.

The results in the “PSE TC Results” column reflect the analysis from the PSE Report, with a dataset update to include 2017 data (with no other changes made). The column labeled “PEG TC Results (2012 Capital Level)” shows the updated PEG results, taken from their Interrogatory Answers. (In their Interrogatory Answers, PEG corrected the initial results from the PEG Report, as a result of PSE’s interrogatory question M1-TH-026 (f).)

¹³ PEG states this on both p. 2 and p. 3 of their response in M1-SEC-13.

¹⁴ P. 2 of PEG’s response in M1-SEC-13.

¹⁵ If the company was not proposing additional capital funding, PSE’s total cost benchmarking results would likely show a 0.15% stretch factor (versus our recommended 0.30%) and PEG’s results would likely show a 0.30% stretch factor (versus their recommended 0.45%).

Table 2 PSE Total Cost Results vs. PEG Total Cost Results

Year	PSE TC Results	PSE—Average Results Prior 3 Years	PEG TC Results (2012 Capital Level)	PEG—Average Results Prior 3 Years
2015	-18.4%		-7.6%	
2016	-15.7%		-3.1%	
2017	-13.8%		-0.2%	
2018	-10.5%	-16.0% (SF=0.15%)	3.5%	-3.6% (SF=0.30%)
2019	-9.3%	-13.3% (SF=0.15%)	4.8%	0.1% (SF=0.30%)
2020	-7.2%	-11.2% (SF=0.15%)	7.5%	2.7% (SF=0.30%)
2021	-5.5%	-9.0% (SF=0.30%)	9.4%	5.3% (SF=0.30%)
2022	-3.3%	-7.3% (SF=0.30%)	11.8%	7.2% (SF=0.30%)
2023	-1.6%	-5.3% (SF=0.30%)	13.8%	9.6% (SF=0.30%)
2024	-0.1%	-3.5% (SF=0.30%)	15.4%	11.7% (SF=0.45%)
CIR Avg.	-3.5%		+11.6%	

For the reasons cited throughout our PSE Report and this Reply Report, we maintain that our benchmarking results are a more accurate depiction of Toronto Hydro's cost performance. If PEG were to correct for the inconsistencies and problems that we have noted in Section 2, their results would converge towards the PSE results. Our recommended single stretch factor, to be fixed and applied to all years, is 0.30% for the reasons articulated throughout the PSE Report and this Reply Report.